Development of Configurable Digital Holographic Microscope for Microfluidics Applications – **Core Research Grant (SERB) (CRG/2020/002015)**

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❖ Highlights

Digital holographic microscopy (DHM) is a versatile imaging technique which simultaneously provides amplitude and phase contrast images of the object. The key features offered by DHM are non-invasive, label-free imaging, numerical focusing, numerical aberration correction, compact and low cost. The aim of the proposed project is synergizing holographic and microfluidic systems on a single platform to capitalize different features offered by both of them as shown in Fig. 1. The prospects of application of the project lies in numerous field such as ow visualization, label-free 3-D cell imaging, high-throughput clinical pathology, etc.

❖ Objectives

- Design and development of configurable common-path digital holographic microscopy system for the simultaneous reconstruction of intensity and phase images.
- Algorithm development and implementation for numerical reconstruction of digital holograms, aberration compensation, phase unwrapping, particle localization in 3-D space, intensity and phase image segmentation and classification.(Fig. 2: one of the results obtained at this stage of the project.)
- Integration of microfluidic system and holographic microscopic system on a single platform.
- Experimental verification of the integrated holographic microscopic and microfluidic system for benchmarking against state-of-the art imaging techniques.

❖ Deliverables

- A configurable holographic microfluidic imaging system
- Software package (MATLAB) for processing and analyzing holograms
    - Application specific software modules especially for object segmentation and classification

❖ Societal Impact

- Application in clinical pathology for cell imaging, flow cytometry for cell characterization and decease detection.
- Application in measurement of pollutants based on micro-particle detection and size estimation

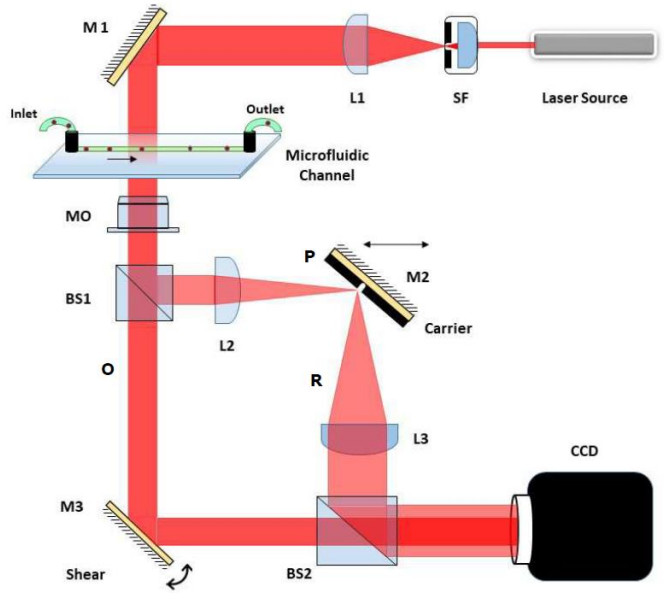

Figure 1: M1,M2,M3: mirror; MO: microscope objective; BS1,BS2: Beamsplitter L1,L2,L3: lens; SF: Spatial filter; P: aperture

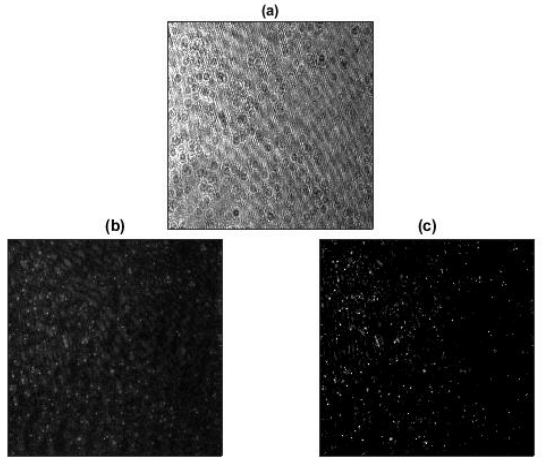

Figure 2: (a) Hologram of polystyrene particles of $40\ \mu m$ diameter. Particle images obtained using (b) conventional reconstruction algorithm and (c) newly developed reconstruction algorithm with improved particle size estimation accuracy